Instructions for insert for Guide to Safety

1. Remove pages vii-ix. Replace them with enclosed corrections.

2. Remove page 8-1. Replace it with the enclosed Chapter 8.

3. Remove Appendix B, pages B-1 to B-8. Replace it with the enclosed Appendix B.

APPROVED FOR RELEASE BY:
W. F. Brown

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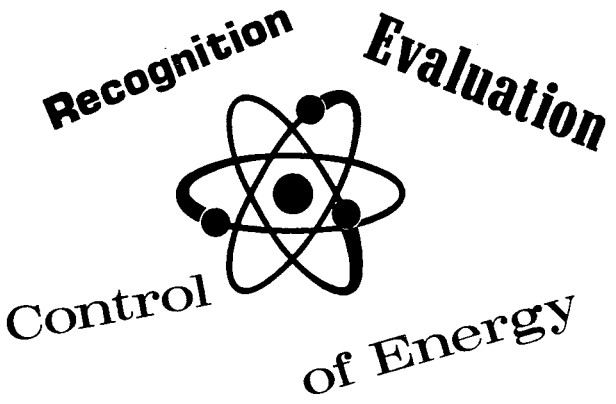
GAT–226, REVISION 3

Guide to Safety



MAY 1979

GOODYEAR ATOMIC CORPORATION
P. O. BOX 628
PIKETON, OHIO 45661
ACTING UNDER CONTRACT EY–76–C–05–0001 WITH THE
U. S. DEPARTMENT OF ENERGY

FOREWORD

The Guide to Safety of the Goodyear Atomic Corporation is a compilation of basic industrial safety practices which apply to our plant. It is hoped that this Guide to Safety will serve as a starting point for new ideas and renewed efforts in the area of safety.

Because this Guide to Safety is only an outline of basic safety practices, employees who want more detailed information on a particular subject should contact their supervision or the safety department. Your interest will be appreciated.

GOODYEAR ATOMIC CORPORATION
P. O. BOX 628
PIKETON, OHIO 45661 PHONE: 614-289-2331

May, 1979

To: All GAT Employees

Subject: SAFETY

During our more than 25 years of operation at the Portsmouth Gaseous Diffusion Plant, Goodyear Atomic Corporation has achieved an outstanding safety record - a record in which we take justifiable pride. The accomplishment was made possible through the cooperation of all plant personnel and the dedication of individual employees to the goal of safety. However, if we are to move forward and improve our present excellent safety record, the continued, dedicated effort of every employee at the plant will be necessary.

The purpose of this manual is to provide basic information on plant safety practices. It will not answer all questions on safety nor will it ensure that all plant operations will be safely carried out. The Guide to Safety is only a beginning. Completion of safe plant operations is the responsibility of the individual worker who must

(1) have a working knowledge of the concepts and principles contained in this manual;

(2) acquire in-depth knowledge of safety practices for his/her particular job;

(3) be continuously alert for ways to improve on-the-job safety and communicate such information so that others may benefit; and

(4) assist other workers in performing their jobs safely.

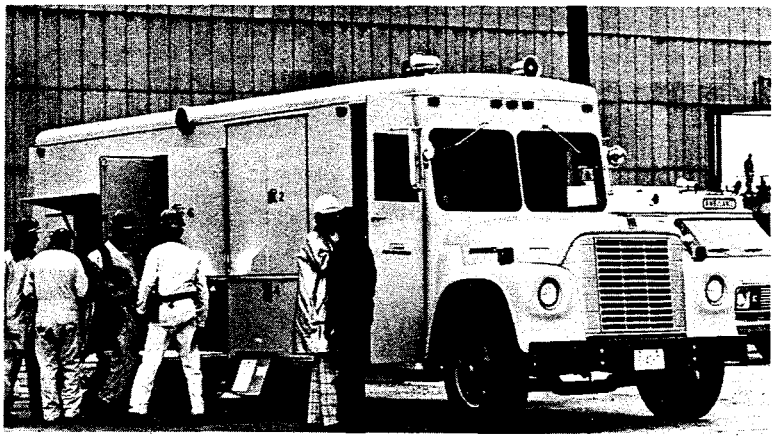
The Goodyear Atomic Corporation places the safety of its employees and that of the general public first on its list of priorities. Official corporate policy on the subject of safety is as follows:

> Under normal circumstances, no task shall be considered so important or so urgent that employees need risk injury to themselves or others, risk damage to equipment, or risk disruption of operations in carrying out work assignments. Safety must be given the same consideration on the job as quality and quantity of production. Whenever other work objectives may conflict with safety, safety shall be given first consideration.

Let us all give safety our first consideration and join the corporate effort to produce a quality product with a completely safe operation. When the goal is safety, any effort less than 100% is unacceptable.

N. H. Hurt
General Manager

ACTING UNDER CONTRACT EY-76-C-05-0001 WITH THE U. S. DEPARTMENT OF ENERGY



EMERGENCY CALLS

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SAFETY ASSISTANCE CALLS

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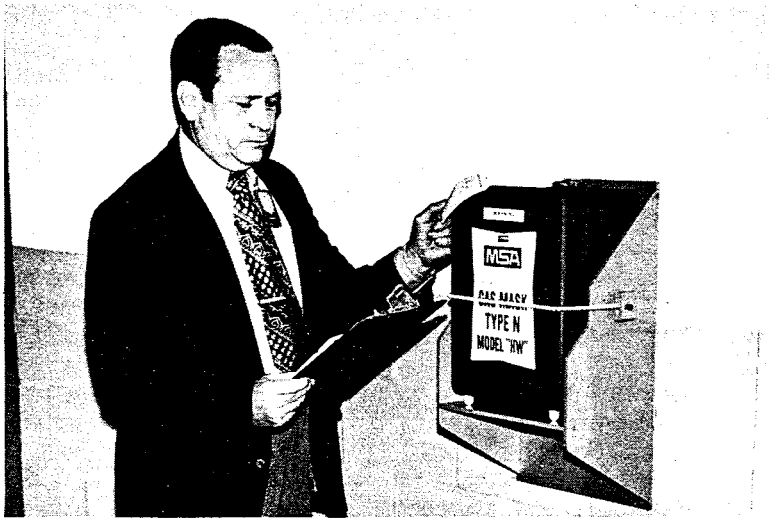


SECTION 1 SAFETY PROGRAM

101 INTRODUCTION

The purpose of the Safety Program of the Goodyear Atomic Corporation (GAT) is to prevent or reduce events and conditions that could result in injury to employees or the general public, or in damage to property.

The Safety Program is carried out through various safety committees. The Executive Safety Committee establishes GAT safety policy and direction. Division and subdivision safety committees evaluate the progress of the Safety Program in their areas. Employee safety meetings provide an opportunity for employees to contribute to our Safety Program by asking questions and expressing their ideas on safety matters.

Supervision leads the accident prevention effort. Supervision detects and controls hazards, investigates accidents and institutes corrective measures, ensures that proper protective equipment and tools are provided and used, trains workers in safe job methods, and encourages employees to participate in the Safety Program.

Although supervision has a large responsibility for safety, the ultimate success of the Safety Program depends upon the safety motivation of the individual employee. His family, his employer, and his fellow workers all depend upon him to complete his job assignment safely. To fulfill his safety responsibilities, each employee must follow these general safety practices and rules:

1. Observe and obey traffic signs, safety signs, STOP tags, radiation barriers, and other visual and physical barriers.

2. Report physical hazards, such as defective tools and equipment, inadequate guards, hazardous processes, etc., to supervision.

3. Use personal protective clothing and equipment for jobs requiring them.

4. Avoid off-balance positions while on ladders or scaffolds.

5. Use proper tools for each task, and always keep tools in good condition.

6. Observe safe lifting methods.

7. Wear eye or face protection in all areas and on all jobs involving the possibility of chemical splashes or flying particles.

8. Wear lineman's rubber gloves whenever there is a possibility of contact with energized electrical equipment.

9. Report and discuss existing or potential hazards at employee safety meetings.

10. Report all injuries, no matter how minor, and obtain medical attention as soon as possible.

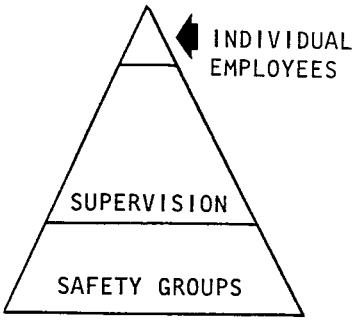
11. Keep work areas clean and orderly.

12. Avoid unsafe acts.

Unsafe acts cause a large percentage of all accidents and injuries. By avoiding unsafe acts and correcting the unsafe acts of others, employees can eliminate many accidents and injuries. When everyone takes an interest in preventing accidents, and each employee is willing to act in the spirit of cooperation, the number of accidents at our plant will be reduced.

102 STAFF AND SERVICE SAFETY GROUPS AND THEIR FUNCTIONS

Five staff and service departments are provided to assist supervision in carrying out the Safety Program. These are: the Safety Department, Fire Protection Engineering Department, Fire Department, Environmental Control Department and Industrial Hygiene and Health Physics Department. The purpose of these departments is to assure that equipment, processes, facilities, and job methods are designed to minimize accidents. These programs serve as the base of a pyramid that can be used as a symbol of the Safety Program. Completing the pyramid are the supervision, who constitute the central portion of the structure, and the individual employees, who serve as the apex.



Safety Department

The Safety Department surveys operations, equipment, facilities, and work habits to uncover unsafe conditions and practices. These surveys are made by qualified engineers with experience in accident prevention. Federal, national, state and DOE standards are used as guidelines for hazard control.

One of the prime responsibilities of the Safety Department is to prescribe protective gear and equipment to be used for jobs with inherent hazards. Surveys are made to determine the type of safety equipment needed, and specifications are prepared for the purchase of proper protective equipment. The equipment and related items, such as ladders and scaffolds, are inspected periodically to evaluate their use and effectiveness in preventing injury or disease.

The Safety Department is also responsible for administering a program to ensure safe operation of equipment systems. The program includes field and shop inspections of such equipment as bridge cranes, hoists, jib cranes, elevators, coded boilers and vessels, slings, chains, and mobile cranes.

Safety promotion and education programs are conducted by the Safety Department through the use of special reports, safety letters, posters, booklets, awards, and the Wise Owl, Golden Shoe, and Turtle Clubs. Educational activities, such as safety orientation of new employees and testing of operators of motor vehicles and industrial equipment, are also administered by the Safety Department.

Fire Protection Engineering Department

The prime function of the Fire Protection Engineering Department is to minimize conditions which may cause a fire or an explosion and result in injury to personnel, damage to property or disruption of production. The department has four major activities: fire prevention, fire control, employee education, and fire analysis. Fires and explosions can be pre-

vented if adequate safety features are incorporated into the initial design of facilities, and if existing hazardous areas and activities are corrected and controlled. Control measures include provision of automatic fire detection and extinguishing systems, as well as first-aid fire fighting equipment (extinguishers, etc.).

Fire Department

The Fire Department is responsible for the control of emergency conditions, including fires and chemical releases, by furnishing emergency equipment and trained personnel to operate this equipment. It also furnishes ambulance service and first-aid for treating field injuries and non-"O" shift medical cases. The Fire Department also trains members of Auxiliary Emergency Squad, who assist the firemen in emergency operations.

Environmental Control Department

The Environmental Control Department is responsible for recognizing, measuring, evaluating, and reporting on environmental conditions due to plant effluents from such agents as radioactive contamination, toxic chemicals, wastes, and all other agents used or created which may have an effect on the environment. This responsibility includes making appropriate recommendations to control, contain, recycle, or dispose of undesirable materials.

Industrial Hygiene and Health Physics Department

The Industrial Hygiene and Health Physics Department is responsible for routine and special measurements of the levels of radiation, radioactive contamination, noise, and toxic chemicals to which GAT employees are exposed or may be exposed. This department also reviews personnel and equipment film badges, urinary excretion results, audiometric examinations, in-vivo monitoring results, and other personnel and area exposure results. Based on the

evaluation of these measurements, department personnel recommend and implement corrective actions for hazardous plantsite conditions. This department also prepares and presents educational programs on various industrial health topics, and evaluates sampling and personal protective equipment.

103 ACCIDENT REPORTING AND INVESTIGATING

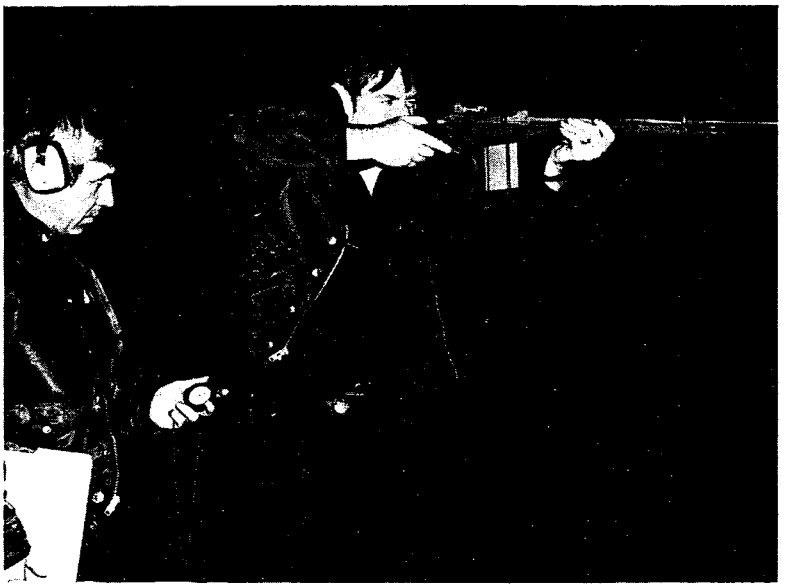
An accident report is a very valuable tool for protecting employees from injury: by identifying the conditions or acts which contributed to an accident, it makes possible their correction, and thereby prevents further accidents of the same type. Therefore, as soon as possible after receiving medical attention, an injured employee and his/her immediate supervision shall discuss the accident. Supervision shall investigate the accident, prepare a "FOREMAN'S REPORT OF ACCIDENT," and identify to the injured employee the necessary preventive action to remove the cause of injury. The accident report is first sent to the Safety Department for analysis and review, and then filed with the medical report of the injury.

In addition, the supervisor or a member of management is responsible for holding a formal investigation of

any occupationally incurred disease or injury which results in loss of time from work or any degree or permanent disability. Formal investigations of other serious or "near miss" accidents will be held when supervision or the Safety Department feels such investigations are appropriate.

104 EMPLOYEE SAFETY MEETINGS

Employee safety meetings provide a means of dissemination of safety information and an opportunity for employees to ask questions about safety and participate actively in the Safety Program by making suggestions for improving safety. An unsafe act or condition cannot be corrected unless there is specific information concerning its existence; therefore, each employee should take full advantage of these safety meetings in order to expose and eliminate actual or potential hazards. All questions and suggestions are brought to the attention of upper supervision and the Safety Department by use of the "Safety Meeting Minutes" form so that the appropriate action can be taken. All questions will be answered.



SECTION 2 GENERAL SAFETY REGULATIONS

201 HAZARDOUS AND ELECTRICAL WORK PERMITS

The procedures for the use of Hazardous Work Permits and Electrical Work Permits are contained in Appendix A and Appendix B, respectively. These procedures should be studied and thoroughly understood.

202 "STOP" AND "DO NOT OPERATE" TAGS

The "Stop" and "Do Not Operate" tags used at the Portsmouth plant are described and their uses are explained in Appendix C. This appendix should be reviewed thoroughly so that the uses and limitations of these tags will be known.

203 MACHINE TOOLS

Only personnel authorized by supervision may operate machine tools. The following general safety rules, as well as special rules established by supervision for certain machinery, must be observed.

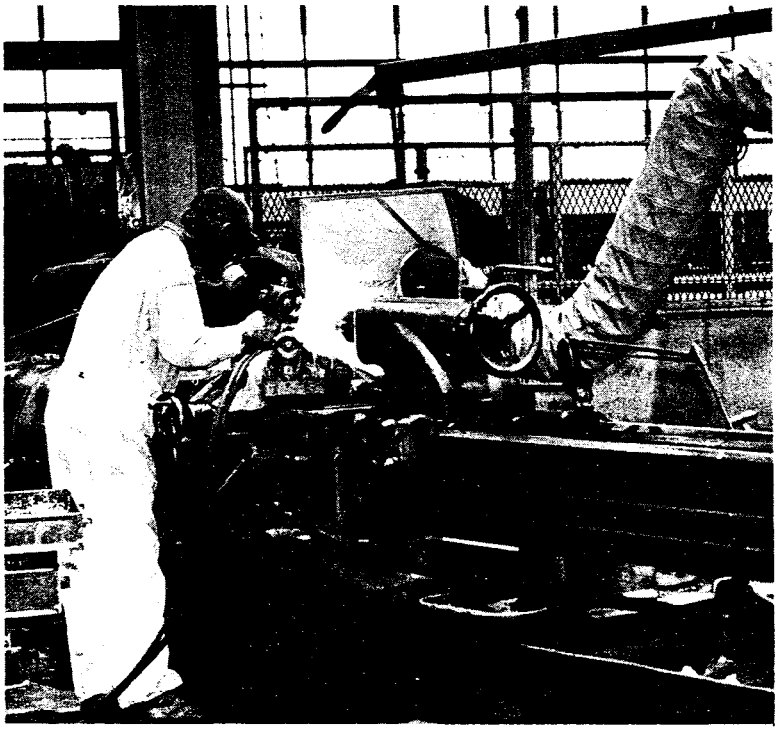
Rules for Operating Machine Tools

1. Operators must not wear gloves or ties.

2. The sleeves of long-sleeved garments must be either rolled up or securely fastened at the wrists.

3. All power-driven gears, sprockets, motor couplings, transmission belts, and pulleys that are 7 feet or less above floor level or platform level must be enclosed in guards constructed of expanded metal, perforated or solid sheet metal, wire mesh, or other material of equivalent or greater strength.

4. Motor-driven machines must have "stop" and "start" buttons located near the point of operation, within easy reach of the operator.



204 COMPRESSED GAS CYLINDERS

Compressed gas cylinders are safe for the purpose for which they are intended. Serious accidents connected with gas cylinders can always be traced to abuse or mishandling.

Rules for Handling Compressed Gas Cylinders

1. Cylinders must never be considered or treated as being empty.

2. Since practical jokes involving use of compressed air have resulted in serious injury or death, compressed air or gas must never be used for horseplay. A compressed gas hose must never be pointed at another employee.

3. Cylinders must not be used as rollers for heavy objects.

4. Cylinders being moved to and from locations where they are used must not be rolled along the floor.

5. A suitable truck carriage with a chain or clamps must be provided for transporting cylinders. The cylinders must be securely blocked in the truck and the valve protector caps must be in place while the cylinders are being moved. The cylinders must be lifted on and off the truck carefully.

6. Cylinders must be securely fastened in an upright position, and valve protection caps must be in place when the cylinders are not in use.

7. Rough handling, such as dropping cylinders or letting them fall over, must be avoided. Also, cylinders must not be struck together.

8. Cylinder valves or supply connections must never be handled with greasy gloves or hands.

9. When a cylinder is not in use, its main cylinder valve must be shut off and the gas from the regulator and supply hose drained.

10. The head connections of all fresh cylinders of gas must be tested for leaks prior to use. A user should always open cylinder valves slowly and stand so that gauges and reducing valves face in the opposite direction from him/her.

11. Cylinders must not be exposed to heat in excess of 125°F. A flame should never come in contact with any part of a cylinder.

12. Gas from a cylinder must not be used if there is any doubt as to the cylinder's contents. Cylinders must be identified accurately and in a standard manner. In case the contents cannot be identified, cylinders must be returned to the supplier, or the Technical Division must sample and analyze the contents. Cylinders must be identified with appropriate symbols, either by tag or adhesive label, as to the contents of the cylinders as designated by the vendor on the shipping papers.

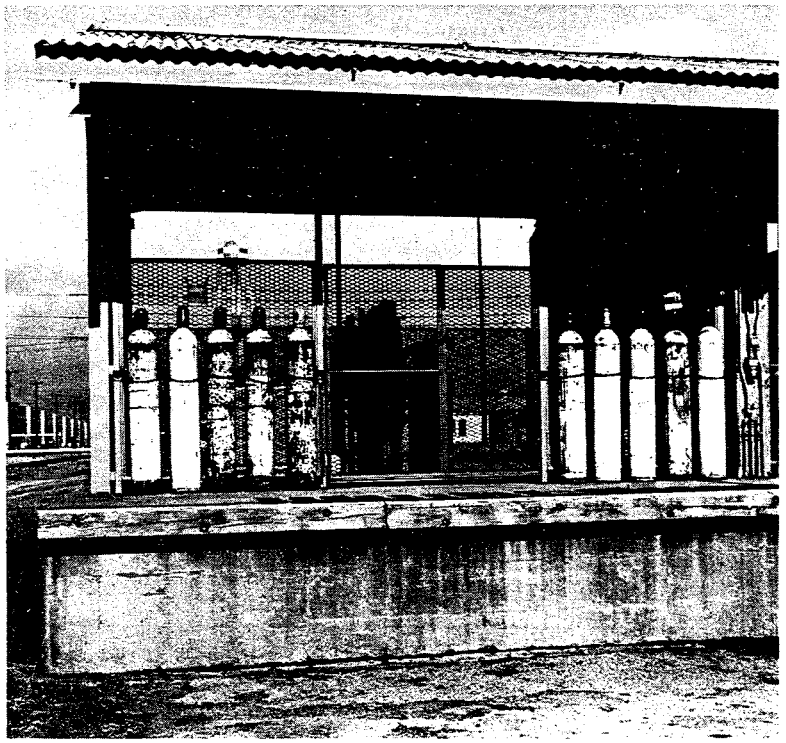
13. When in use, each acetylene or fuel gas cylinder must be equipped with a valve wheel or valve wrench, which must be left in position on the stem of the valve. Either of these devices permit the fuel gas flow to be shut off quickly in the event of an emergency.

14. A cylinder covered with ice and snow must be thawed at room temperature or with water at a temperature not exceeding 125°F.

15. Empty and full cylinders must never be stored together, and cylinders containing different gases must be stored separately.

16. All cylinders shall be stored in a properly identified location, separated by contents, whether empty or full.

17. Each department must insure that the cylinders it uses are in good condition. If a defective cylinder is found, the Safety Department should be contacted for proper disposition.



A cylinder identification color code has been established for use by GAT. Company-owned cylinders are painted the appropriate colors, while adhesive labels or appropriate tags are used on some vendors' cylinders. The same color code is used on both the adhesive labels and the cylinders, but the main body of the vendors' cylinders may be of various colors. The identification color code for compressed gas cylinders is given on the following page.

IDENTIFICATION COLOR CODE FOR
COMPRESSED GAS CYLINDERS

Cylinder Contents	Body Color	Identification Stripe Color
Acetylene	Black	Red
Argon	White	Green
Butane	Tan	Red
Carbon Dioxide	Purple	Green
Carrene #500	Purple	Yellow
Chlorine	Yellow	Orange
Chlorine Trifluoride	Yellow	Red
Fluorine	Yellow	Black
Freon (12)	Purple	White
Freon (22)	Purple	White
Freon (113)	Lt. Green	Brown
Freon (502)	Lt. Green	Brown
Helium	Orange	Black
Hydrogen	Tan	Red
Hydrogen Sulfide	Yellow	Red
Insto-Gas	Tan	Red
Methane	Tan	Red
Nitrogen	White	Blue
Oxygen	White	Yellow
Propane	Tan	Red
Sulfur Dioxide	Yellow	Green
Mixed Gases (N_2-H_2)	Tan	Red
Mixed Gases (Ar-Methane)	Pink	Black
Mixed Gases (Ar-CO_2)	White	Red

205 PORTABLE LADDERS

Only heavy duty industrial wood or alloy ladders that meet the ANSI-A-14.1 "Safety Code for Portable Wooden Ladders" and ANSI-A-14.2 "Safety Code for Portable Metal Ladders" are procured for use at the Portsmouth plant. All ladders are carefully inspected for defects, and wooden ladders are treated with linseed oil prior to use.

Rules for Using Ladders

1. Inspect ladders thoroughly before each use. Do not use ladders in questionable condition; instead, report such ladders to supervision.

2. Do not use single or extension ladders without safety feet.

3. Place single or extension ladders so that the horizontal distance from the base to the vertical plane of support is approximately one-fourth of the ladder length.

4. For stability, securely lash the ladder at the top or hold it at the bottom.

5. Use stepladders only when the spreaders are in a fully open position.

6. During ascent or descent, face the ladder and use both hands to grasp the side rails.

7. Do not climb higher than the third rung from the top of a single or extension ladder or the second step from the top of a stepladder.

8. Do not place ladders in front of doors that open in the direction of the ladder without barricading the door opening.

9. Do not place ladders in passageways to vehicular traffic without barricading the area around the base of the ladder.

10. Avoid ladders while shoes are muddy or greasy.

11. Do not permit more than one person on a single ladder at a time. (However, two employees are permitted on a stepladder at the same time providing the ladder is constructed so that both sides may be used.)

12. Do not slide down the rails or perform any other stunts on ladders.

13. Do not paint wooden ladders.

206 FLUORESCENT LIGHT TUBES

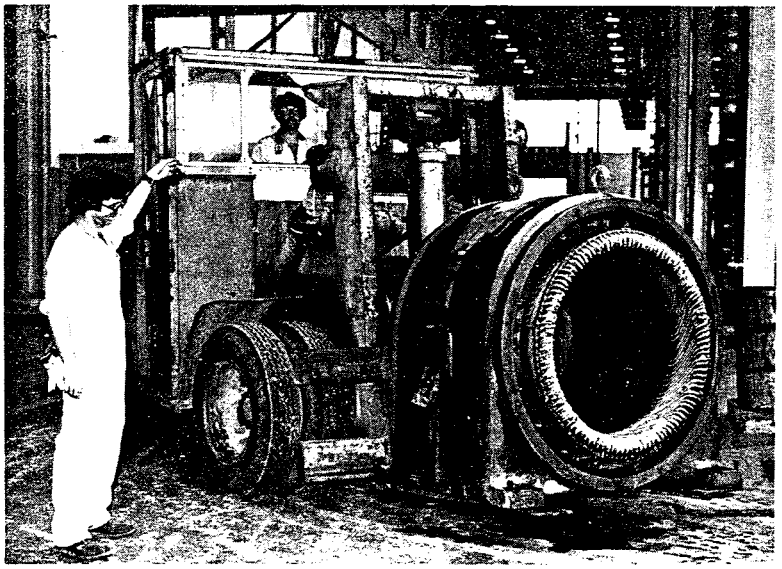
The inner surface of the wall of fluorescent light tubes is coated with a light-emitting substance that is usually fluorescent or phosphorescent material. The tube is filled with mercury vapor at extremely low pressure. Because of the use of these chemicals, special precautions must be observed in the handling and disposal of fluorescent light tubes.

207 LANE MARKING TAPE

Lane marking tape is used at various locations on plantsite to indicate and control hazards. Color codes for lane marking tape have been established as follows:

COLOR CODES FOR LANE MARKING TAPE

Color Code	Use
Yellow and Black, 45°	To warn personnel and to provide a "do not cross" barrier for vehicles in front of electrical switchgear, control panels, pumps, cold traps, etc.
Orange	To mark "spacing" for criticality considerations.
White	To designate "safe" walkways for criticality considerations.
Yellow	To serve as an "all purpose" marking except where criticality is involved.



208 ENTRY INTO CONTAMINATED PIPING

From time to time it becomes necessary to remove extraneous materials from process piping and associated equipment. A Hazardous Work Permit (HWP) must be issued for every job requiring entry into contaminated piping and equipment. The Safety Department should be consulted before the HWP is issued if the entry is anything other than routine. Protective gear indicated on the HWP may vary, but a lifeline must be attached to the individual who enters the piping, and this individual must not be permitted to go beyond the point where he/she can easily be extricated.

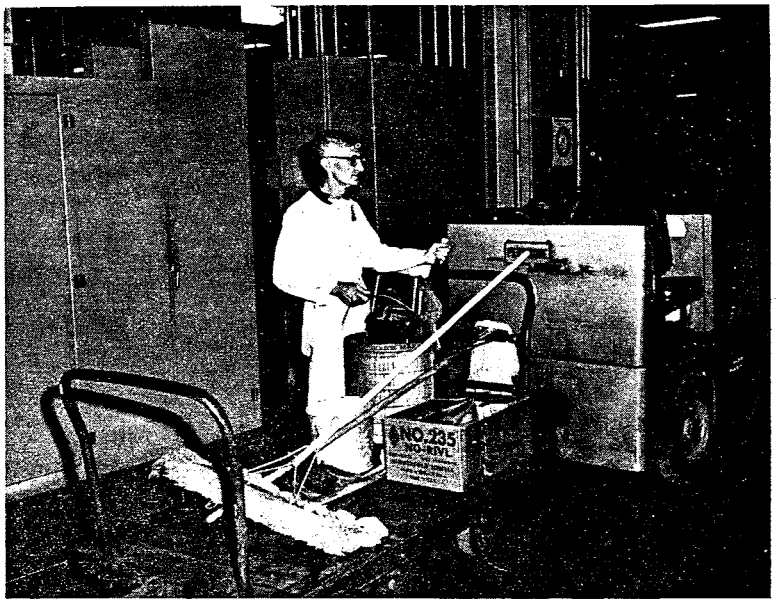
209 SAFETY BELTS

Safety belts, harnesses, and lanyards are provided for use where there is danger of falling or where entry is made into certain enclosures. In general, safety belts must be worn by employees working on scaffolds suspended by ropes or rope falls; in addition, each employee on such scaffolds must be furnished with a lifeline firmly attached to a point independent of the scaffold rigging.

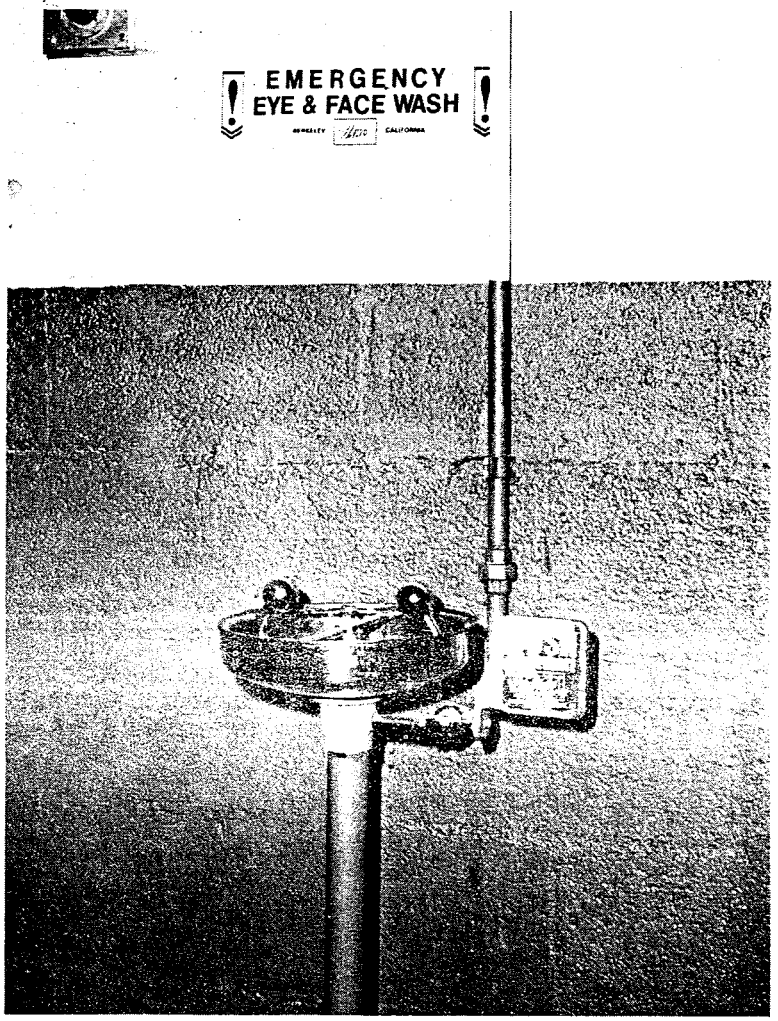
Safety belts must also be worn when employees are working on elevated platforms or areas not provided with guardrails. In addition, safety belts or wrist straps equipped with lifelines must be worn when entry is made into tanks, pits, and other enclosures of limited area where toxic contaminants or oxygen-deficient atmospheres may exist.

210 HOUSEKEEPING

Each employee is responsible for the housekeeping in his/her assigned work area. Poor housekeeping results



from poor work habits. Debris on the floor represents a tripping and/or slipping hazard. Generally speaking, a sloppy housekeeper is also a sloppy worker.



SECTION 3 INDUSTRIAL HYGIENE – OCCUPATIONAL HEALTH HAZARDS

301 GENERAL

Industrial hygiene encompasses the recognition, evaluation, and control of environmental factors or stresses which may induce sickness, impaired health,

or discomfort in employees. These occupational health hazards may be classified as chemical, physical, or biological in nature.

An essential element of any industrial hygiene program is employee awareness of the potential hazards in the workplace. The material in this section provides general background for the hazards that may be encountered on plantsite; but each employee, with the help of supervision and Industrial Hygiene, should become familiar with the specific hazards in his/her work area. Such knowledge will help create a safe, productive work environment.

302 EXPOSURE TO CHEMICAL AGENTS

Chemical agents can enter the body through three routes: inhalation, skin contact and absorption, or ingestion. Inhalation and skin contact are considered the most significant because many occupational disabilities result from the inhalation of dusts, fumes, vapors, gases and mists, or from skin contact with various substances. Certain gases, vapors, and liquids are classified as asphyxiants, irritants, anesthetics and narcotics, or systemic poisons according to the biological reactions prevalent after exposure to them. Exposure to dusts can generate several distinct types of health impairment, such as pneumoconiosis from inhalation of dusts, systemic toxic effects following inhalation or ingestion of certain dusts, and allergic reactions caused by inhalation of pollen or other organic dusts. Finally, occupational skin disease (dermatosis) accounts for many worker maladies.

Threshold Limit Value

An assessment of airborne, chemical hazards requires an understanding of the framework in which these stresses are evaluated. Employee exposures are dependent upon two main factors: contaminant concentration and length of exposure. The relative importance of these factors depends on whether the primary hazards of the substance are from chronic

(long-term) or acute (short-term) exposure, or both. Time-Weighted Average Threshold Limit Values (TLV-TWA) and Short Term Exposure Threshold Limit Values (TLV-STEL) are concentrations of airborne contaminants.

The TWAs represent environmental conditions to which nearly all workers may be repeatedly exposed, over a working lifetime, without experiencing adverse effects. Basically, a TWA refers to a time-weighted average exposure for up to a ten-hour day and a forty-hour workweek. It is directed toward chronic exposures rather than acute exposures. Furthermore, these levels have been developed for normal individuals doing normal work. They do not apply to extreme environmental conditions of high heat or unusual humidity, or to activities involving heavy exertion. In such circumstances the increased stress placed upon the body results in a greater response to a toxic substance.

Normally, an exposure to a STEL concentration is limited to 1 or 2 exposures per day with a recovery period between exposures, providing the daily average exposure never exceeds the TWA. STELs are designed to prevent acute adverse effects.

The published TWA and STEL values for occupational exposures are used as guidelines for evaluating worker exposures and determining whether any engineering or personal protective measures are necessary to prevent adverse health effects.

Chemical Stresses - Biological Effects

Asphyxiants

Simple: Gases that act principally as simple asphyxiants and have no other significant physiological effects may dilute the atmospheric oxygen content below the level necessary to sustain life.

Example: Carbon Dioxide

Chemical: Through chemical action, either the blood is prevented from reaching the lungs or the oxygenation of tissues is restricted. As a result, even if the atmospheric oxygen content is adequate, the exposed person may show symptoms of oxygen deficiency.

Examples: Carbon Monoxide
Cyanide
Phosgene

Irritants

These are substances that react with moist surfaces or mucous membranes and have a corrosive action, causing inflammation or burning of tissues. The degree of damage is generally more dependent on concentration than on time of exposure.

Examples: Ammonia
Fluorine
Hydrogen Chloride
Trichloroethylene
Chlorine
Sulfur Dioxide

Anesthetics-Narcotics

These chemicals depress the central nervous system by reducing the partial pressure of oxygen in the blood supply to the brain.

Examples: Trichloroethylene
Gasoline

Systemic Poisons

Following exposure by any route, a substance may be absorbed and distributed in the body to cause tissue damage to body organs. It may or may not exert toxic effects at the site of entry as well. Such a substance is called a systemic poison.

Examples:
Non-Metallic Inorganics: Fluorides
Toxic Metals: Mercury, Cadmium, Nickel, Uranium, Lead

Carcinogens

These substances are capable of inducing cancer in man and/or animals, and occupational exposure to them may increase the risk of cancer to the worker.

Examples: Asbestos
Benzene

Pneumoconiosis-Producing Dusts

Pneumoconiosis is a fibrous hardening of the lungs caused by irritation resulting from inhaled dust deposited in the lungs. Certain types of dust produce pneumoconiosis with additional specific, irreversible lung changes.

Examples: Silicon dioxide (found in quartz sand)
Asbestos
Talc

Allergic Reactions

Organic dusts may produce allergic reactions, such as hay fever or specific skin irritations. Reactions may be caused by exposures to some types of wood dust or pollens.

Industrial Dermatitis

Irritant contact dermatitis produces a recognized irritating effect at the area of skin contact. Some agents react quite rapidly to destroy tissue and produce chemical burns, while others may not show a response until hours after the exposure.

Examples: Nitric Acid
Sulfuric Acid
Sodium Hydroxide

Sensitization dermatitis may result from exposure to a chemical which is both an irritant and a sensitizer. Irritation may or may not result from the initial exposure. However, after extended or repeated exposures, an allergic skin reaction may develop upon exposure occurring weeks or months after the initial exposure. Once an individual has become sensitized, even a slight exposure may cause a severe outbreak of dermatitis.

Examples:	Photo Developers	Synthetic Resins
	Creosote	Soap Powders (Deter-
	Chlorophones	gents)
	Poison Ivy	Azo Dyes

Industrial dermatitis may result from exposures to chemical, mechanical, physical, or biological agents.

303 EXPOSURE TO PHYSICAL AGENTS

The hazards associated with physical agents and environmental conditions result from the transmission of residual energy through the air or through a tool with which an employee is in contact. Some physical agents, such as noise, vibration, heat, and illumination, may be detected by the senses, while others, such as ionizing radiation, cannot.

A detailed discussion of ionizing radiation is presented in a subsequent section.

Noise

Noise is usually defined as unwanted sound. Excessive exposures to loud noise may cause hearing damage, depending upon the intensity and the duration of the exposure. To prevent occupational hearing loss, OSHA

has promulgated a noise standard which limits employee exposures to 90 dBA for eight hours per workday. Exposure to higher sound levels is permitted with a decrease in exposure time. For each halving of the exposure time, the noise level may be increased by 5 dBA, up to a maximum of 115 dBA. At GAT, additional safeguards have been implemented which are independent of exposure time. Use of hearing protectors is recommended whenever workplace noise levels reach 85 dBA and is required for levels which exceed 90 dBA. Certain operations and equipment are inherently noisy and may require the use of hearing protection devices. Examples of such equipment are as follows:

drills	saws
air hammers	conveyors
compressors	air-jets
motors and generators	pumps
fans	arc-air scarfing
crushers	spray guns

Vibration

Vibration may cause discomfort and even motion sickness in some people. Intense vibration may impair circulation in hands and feet, may induce muscular numbness or pain, or may even cause injury to bones and joints. Repeated motions or shocks can cause irritation and inflammation of the tender sheath of the hands and arms. Operators of pneumatic tools, such as air hammers, compressed air drills, riveting guns, jack hammers, and heavy construction equipment, routinely experience intense vibration.

Temperature Extremes

Abnormal conditions of heat or cold can adversely affect an individual's work performance. A person must maintain a body temperature of about 98.6^{o}F. In extreme conditions of heat, the body is unable to release excess heat through radiation, convection, or sweating, and the result is fatigue, loss of efficiency, and even physical collapse. On the other

hand, shivering will instantly increase the metabolic rate to counteract body cooling. During continued cooling, a person may engage in deliberate physical activity to increase heat production. Exposure to abnormally cold temperatures can cause frost-bite.

Heat exchange between the human body and the environment depends upon four external physical parameters: air temperature, radiant temperature, air velocity, and moisture content of the air. These four factors may be independently varied and combined to produce identical thermal effects on man. For example a decrease in relative humidity will offset a rise in air temperature; thus, man can tolerate a high air temperature better if the relative humidity is low.

Illumination

Adequate illumination is important in all industrial operations. While poor illumination is not necessarily a health hazard in the usual sense, it may cause eye strain and fatigue and may adversely affect safety conditions.

For good illumination, both quality and quantity are important. Quality incorporates brightness, glare, color, diffusion, and uniformity. Quantity signifies the amount of light illuminating the work area. The judgment as to whether an area is properly illuminated cannot be founded solely upon intensity (quantity) data. Any discussion of illumination should consider the "human element." Often, individuals with "normal vision" may require three or more times as much light as others just to obtain the same visual acuity. Furthermore, it has been demonstrated that older workers often require much more light than their younger counterparts. Thus, the evaluation of illumination cannot rest solely upon a comparison between measured and recommended illumination levels.

Non-Ionizing Radiation

Non-ionizing radiation includes, in addition to visible light, infrared and ultraviolet light, lasers, microwaves, radio waves, etc. In general, the principal harmful effect attributed to non-ionizing radiation is that it can cause burns to the skin, eyes, and other body organs. Of these, the eye is probably the organ most susceptible to damage from this type of radiation.

SOURCES AND EFFECTS OF NON-IONIZING RADIATION

Radiation	Industrial Sources	Biological Effects
Ultraviolet	Sunlight, electric-arc welding, "black" lights.	Irritates and damages eye tissue; can cause painful sunburn.
Infrared (IR)	Emitted by all heated bodies. Used for drying and baking paints, varnishes, and enamels.	Short wavelength IR can cause damage to the retina, iris, cornea, and lens of the eye. Can cause acute skin burns.
Microwaves	Food ovens and some drying processes.	Penetrates deeply into the body causing a rise in the temperature of muscular and underlying tissues.

Mechanical Factors

Mechanical agents which often cause skin reactions are friction, pressure, and trauma. These reactions can take the form of abrasions, irritations, blisters, contusions, or lacerations. A typical "mechanical" cause of skin irritation is glass fiber. Although chemically inert, the small fibers or particles become embedded in the skin, causing an itch. The subsequent scratching and rubbing produces dermatitis. Once the skin is broken, it is more susceptible to infection.

Innate Human Factors

There are many factors which predispose an individual to greater than normal development of poor skin conditions. These factors include age, skin textures, allergies, and lack of cleanliness. Personal cleanliness is probably the most significant. Dermatitis is a direct function of the length of time that the skin is in contact with a chemical or other agent. Persons who do not wash or bathe frequently and do not wear clean clothes lengthen the time during which the skin remains soiled and increase their chances of developing dermatitis.

304 EXPOSURE TO BIOLOGICAL AGENTS

Biological agents include bacteria, fungi, and parasites, which attack the skin and produce primary or secondary types of skin irritation. Some are microorganisms and parasites which act on the skin to produce dermatitis, such as athlete's foot. Some biological agents are responsible for respiratory ailments. Several of the serious diseases caused by bacteria include typhoid fever, cholera, and dysentery. These bacteria, which can contaminate food and water supplies, are carried by insects, rodents, and dirty hands. Bacterial food poisoning caused by improper refrigeration is perhaps the most widely known.

305 COMMON CHEMICAL COMPOUNDS

Many of the chemical compounds used in plant operations may be considered toxic or otherwise hazardous. Although these substances or closely related compounds may be commonly used in the home, their use in industry is often more frequent, in higher concentrations, and in larger quantities. Some of these substances will decompose to form toxic materials when brought in contact with heat, moisture, or acids. The following potentially dangerous substances are frequently used at Portsmouth:

Asbestos

Properties:

- Asbestos is a natural fibrous material consisting of a group of mineral silicates. It occurs in a variety of natural forms. It has excellent fire resistant and insulating properties.

Effects:

- Chronic inhalation of asbestos dust can result in a disease known as asbestosis. This malady is characterized by formation of plaques in the lungs which reduce lung capacity and elasticity.

- Exposure to asbestos dust has been shown to increase the risk of bronchial and lung cancer. The hazard is much greater for workers who smoke cigarettes.

Use:

- Asbestos materials are commonly used as pipe insulation, fire resistant cloth, brake linings, and packing for the cooling towers.

Calcium Oxide (CaO-Lime) and Calcium Hydroxide ($Ca(OH)_2$-Slaked Lime)

Properties:

- Calcium oxide is a white or grayish-white hard compound.

- Calcium hydroxide is a soft, white crystalline powder.

- Calcium oxide combines with water to form calcium hydroxide and liberate heat.

Effects:

- Both calcium oxide and calcium hydroxide are caustic irritants to the skin, eyes, and respiratory system.

- Dermatitis may result from excessive exposures.

Use:

- Lime is used primarily in the water treatment facilities.

First Aid:

- In case of eye or skin contact, immediately flush with water.

Chlorine (Cl_2)

Properties:

- Chlorine is a pale yellow or geenish-yellow gas having a characteristic, pungent odor.

- Under certain conditions, chlorine can combine with moisture to liberate oxygen and form hydrochloric acid (HCl).

Effects:

- Chlorine is extremely irritating to the eyes and mucous membranes of the respiratory tract.

- Both chlorine and HCl, if present in quantity, can cause inflammation of the tissues with which they come in contact. Chlorine may cause skin infection and ulcer formation in the nose and on the skin.

Use:

- Chlorine is used principally at the water treatment facilities.

First Aid:

- Following an excessive exposure, immediately irrigate the affected area with water.

Chlorine Trifluoride (ClF_3)

Properties:

- At room temperature, chlorine trifluoride is a suffocating, colorless gas with a sweet, pungent odor.
- It is a very reactive compound which will react violently with most substances.
- It will ignite upon contact with many organic compounds and react with water or steam to produce heat and corrosive fumes.

Effects:

- In very dilute concentrations, chlorine trifluoride will cause irritation of the eyes, nose, and respiratory system. Higher concentrations will cause deep burns in the eyes and on exposed portions of skin.

First Aid:

- In case of eye or skin contact, immediately flush with water.

Chromium Compounds - Chromic Acid and Sodium Dichromate

Properties:

- Chromic acid is dark, purple-red in color, while sodium dichromate is a red crystalline compound.

Effects:

- Chromic acid and its salts have a corrosive action on the skin and mucous membranes producing ulcers known as "chrome holes." These are found frequently on the hands and forearms and are of greatest concern when they occur in the nose. Although fairly painless, they are quite deep, heal slowly, and leave scars.

- Studies have indicated that some chromium compounds may pose an increased risk of cancer to exposed persons.

Use:

- Chromic acid is used as a cleaning solution.

- Sodium dichromate is used in the treatment of recirculating water (RCW).

First Aid:

- In case of eye or skin contact, all affected areas should be thoroughly flushed with water.

Fluorine (F_2)

Properties:

- Fluorine is a yellow, highly reactive gas with a sharp odor.

- It reacts slowly with moisture in the air to form hydrogen fluoride, but will react quite readily with organic materials.

Effects:

- Fluorine is highly irritating to the skin, eyes, and tissues lining the mouth, throat, and respiratory passages, and may burn any of these.

Use:

- Fluorine is used to dry, stabilize and condition cascade equipment and uranium hexafluoride (UF_6) cylinders and to convert uranium oxides to UF_6.

First Aid:

- In case of eye or skin contact, flush immediately with water.

Hydrogen (H_2)

Properties:

- Hydrogen is a colorless, odorless, tasteless and highly flammable gas.

- It is explosive in a wide range of concentrations, and all explosive mixtures are easily ignited.

- Since it is very light, once released to the atmosphere, hydrogen dissipates very quickly unless trapped in a confined space.

Use:

- Hydrogen is purchased in cylinders. Furthermore, it is a by-product in the generation of fluorine

and is released when wet-cell storage batteries are being charged.

Hydrogen Fluoride (HF)

Properties:

- Hydrogen fluoride is a colorless, fuming corrosive gas or liquid. Its aqueous solution is commonly referred to as hydrofluoric acid.

Effects:

- Hydrogen fluoride is highly irritating and corrosive to the skin and mucous membranes. Burns from concentrated solutions of hydrofluoric acid usually produce extreme pain within seconds; but burns from dilute solutions are not readily apparent, and if not treated, may develop into slow healing ulcers.

Use:

- HF is used in the fluorine generation process and is produced when uranium hexafluoride (UF_6) comes in contact with moisture.

First Aid:

- In case of eye or skin contact, immediately flush with water.

Nitric Acid (HNO_3)

Properties:

- Nitric acid is a colorless or yellowish, fuming corrosive liquid with an acrid odor.

- The exact composition of the "fumes" or vapor produced by nitric acid depends upon such environmental factors as temperature, humidity, and whether or not the acid comes in contact with other materials, such as copper, zinc, wood, or paper. Depending upon these factors, the vapor will consist of a mixture of the various oxides of nitrogen and nitric acid vapor.

Effects:

- Nitric acid vapor is highly irritating to the mucous membranes of the eyes and respiratory tract. It is corrosive to all body surface areas.

- The acid and its concentrated vapors produce immediate, severe, and penetrating burns to the skin. Concentrated solutions stain the skin a bright yellow or yellowish-brown and may also leave scars.

Use:

- Nitric acid is used in decontamination and recovery operations.

First Aid:

- In case of eye or skin contact, flush immediately with water while removing contaminated clothing.

Polychlorinated Biphenyls (PCBs)

Properties:

- These are synthetic chlorinated hydrocarbon liquids used as coolants in transformers and capacitors. They are non-combustible and highly fat-soluble.

- Pyranol is the trade name of the product used most frequently at the Portsmouth plant.

Effects:

- Due to high fat solubility, these substances will accumulate in body fat.
- PCBs may cause headache, eye swelling, and temporary vision impairment.
- Studies have indicated that occupational exposure to PCBs may result in increased risk of cancer.

Use:

- Pyranol is used in some transformers and condensers.

First Aid:

- In case of eye or skin contact, flush immediately with water and continue for at least 15 minutes.

Sulfur Dioxide (SO_2)

Properties:

- Sulfur dioxide is a suffocating, irritating, colorless gas having an odor similar to that of rotten eggs.
- In moist air, it combines with water to form sulfurous acid, which is very slowly oxidized to sulfuric acid.

Effects:

- Because sulfur is very soluble, its main action is in the upper respiratory tract, i.e., nose, throat, windpipe, and bronchi. These tissues may swell, restricting the passage of air.

- It is very dangerous to the eyes, as it causes irritation and inflammation of the conjunctiva.

Use:

- Sulfur dioxide is emitted by the steam generating plant and is used in the liquid effluent treatment facility for chromate removal.

First Aid:

- If toxic symptoms occur, personnel should immediately be removed to fresh air.

- If the eyes are affected, they should be thoroughly flushed with warm water.

Sulfuric Acid (H_2SO_4)

Properties:

- Concentrated sulfuric acid is a colorless, oily liquid. More dilute solutions resemble water in appearance.

Effects:

- Skin contact results in rapid tissue destruction, causing severe burns.

- Repeated contact with dilute solutions can cause dermatitis.

- Sulfuric acid fumes and mists cause coughing and irritation of the mucous membranes of the eyes and upper respiratory tract.

Use:

- Sulfuric acid is used primarily in water treatment facilities and wetcell storage batteries.

First Aid:

- Upon exposure, immediately flush the affected area with water. Continue flushing until the affected area is thoroughly irrigated; then flush with a solution of sodium bicarbonate ($NaHCO_3$) to neutralize the acid.

1,1,1 - Trichloroethane (Methyl Chloroform - Cl_3CCH_3)

Properties:

- Trichloroethane is a volatile, colorless liquid with an aromatic odor similar to that of fabric cleaners and spot removers used in the home.

Effects:

- Eye contact may result in pain, discomfort, and irritation.

- As with most solvents, dermatitis might result from repeated skin contact, but the compound is poorly absorbed through the skin.

- Inhalation will result in central nervous system depression, causing anesthetic effects.

Use:

- 1,1,1 - trichloroethane is used as a solvent and as a degreasing and cold cleaning agent.

- At the Portsmouth plant, it is purchased under such brand names as Chlorothene VG, Chlorothene NU, and National 614.

First Aid:

- Upon exposure, remove wet clothing. If eyes are affected, thoroughly flush with water.

Trichloroethylene ($Cl_2C=CHCl$)

Properties:

- It is a clear liquid with a sweet "chlorinated hydrocarbon" odor.

Effects:

- Inhalation of high concentrations causes narcosis and anesthesia. Prolonged inhalation of moderate concentrations causes headache and drowsiness. The primary toxic effect is the depressant action of the central nervous system.

- A few drops in the eye will result in transient pain and conjunctival irritation.

- Studies have indicated that trichloroethylene may lead to increased risk of cancer in exposed persons.

Use:

- Trichloroethylene is used as a degreasing agent.

First Aid:

- Upon exposure, remove wet clothing. If eyes are affected, thoroughly flush with water.

Uranium Hexafluoride (UF_6)

Properties:

- Uranium hexafluoride is the chemical commonly referred to as process gas or "PG."

- Upon contact with the moisture in the atmosphere, uranium hexafluoride hydrolyzes, liberating a dense white smoke of uranyl fluoride (UO_2F_2) and fumes of hydrogen fluoride (HF).

Effects:

- The hazards associated with hydrogen fluoride have been outlined in a prior section. Radiological hazards are discussed in a subsequent section.

- The chemical toxicity of soluble uranium compounds is largely shown in kidney damage.

Welding Fumes and Gases

The potential harm from gases and fumes generated by a welding operation depends upon the chemical composition of the fume, the concentration in the breathing zone, and the duration of worker exposures. The more important air contaminants include ozone, carbon monoxide, oxides of nitrogen, and the various specific constituents of the electrode, electrode coating, and material being welded.

Metal fumes commonly experienced at the Portsmouth plant include iron oxide, copper, nickel, aluminum, and zinc oxide. Compounds which are contained in

welding rod coatings include oxides of various metals, hydroxides, carbonates, silicates, fluorides, and organic materials. There is also a hazard of overexposure to ultraviolet (UV) light, but this is easily controlled by the filtering action of the face shield.

Pesticides

Pesticide is a general term for that group of chemicals used to control or kill such pests as rats, insects, fungi, bacteria, weeds, etc. Included in this group are insecticides, herbicides, fungicides, rodenticides, fumigants, and repellents. Even though many of these chemicals are extremely toxic, they can be used safely, provided the following practices are observed:

1. Store all pesticides in a secure place in the original container.

2. Read all labels, instructions, and operating specifications carefully and follow the prescribed precautions.

3. Do not smoke while using pesticides.

4. Do not breathe spray mist or dust.

5. Do not allow pesticides to come into contact with eyes, skin, or clothing. If spilled on skin or clothing, wash thoroughly with soap and water and change clothes.

6. Wash hands before eating or smoking.

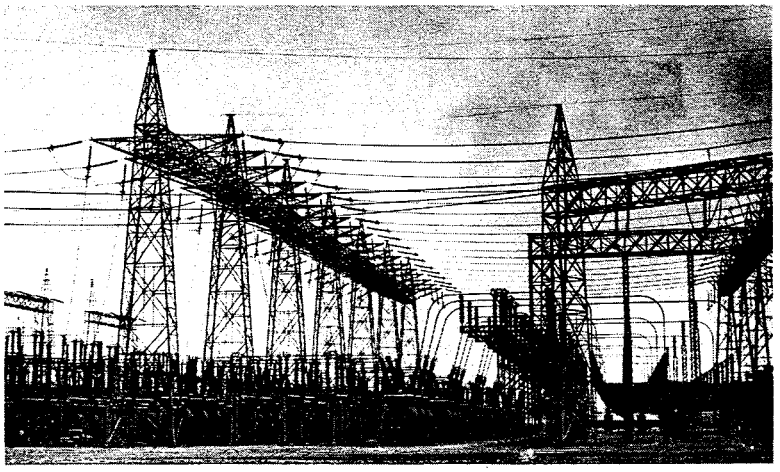
The following pesticides may be seen in use at the Portsmouth plant:

Simazine	Sodium Pentachlorophenol
2,4-D	Synergized Pyrethrin
Warfarin	Strychnine-Impregnated Corn
Malathion	

306 CONCLUSIONS

The preceding passages have outlined some of the potential hazards associated with work at the Portsmouth Gaseous Diffusion Plant. The sections were not intended to frighten any employee, but to increase each employee's awareness of the immediate working environment. If established operating specifications and recommended health protection measures are followed, the possibility of experiencing excessive exposure is reduced. In some instances, an employee will be required to use certain protective equipment, such as coveralls, gloves, ear protection, aprons, respirators, face shields, safety eyeglasses, etc. Supervision in work areas where these precautions are necessary, are acquainted with these special precautions. All employees should become acquainted with the potential hazards in their work areas and with the emergency procedures they should use in case of an accident.

Any employee who has been excessively exposed to chemical, physical, or biological agents should report to the GAT hospital for medical examination and possible treatment.



SECTION 4 ELECTRICAL SAFETY

401 EFFECTS OF ELECTRICITY ON HUMANS

It is an established fact that all normal electrical voltages can be hazardous. Death has resulted from contact with levels as low as 12 volts. Death or injury from electrical shock may result from the following effects of current on the body:

1. contraction of the chest muscles;

2. temporary paralysis of the nerve center, which may result in respiratory failure;

3. interference with normal rhythm of the heart;

4. suspension of heart action by muscle contraction;

5. hemorrhages and destruction of tissues, nerves, and muscles; and

6. secondary effects, such as falls, etc.

402 LOW VOLTAGE ELECTRICAL SHOCK AND ARTIFICIAL RESPIRATION

The effects of any shock a person receives depend on many conditions, such as the extent of the contact, the type of connection to the ground, the condition of the body, etc. The dry, outer skin on a person's body has a very high resistance to current flow. However, this resistance drops to practically nothing when the skin is wet, particularly from perspiration.

Persons suffering low voltage shock are often unable to break the contact due to loss of muscular control and, therefore, suffer more extensive injuries than would normally be expected. However, only trained personnel should attempt to remove a victim from an electrical circuit. The following sequence of steps should be followed:

1. Disconnect or de-energize the circuit, if possible;

2. If a circuit cannot be de-energized, use electrician's rubber protective equipment;

3. Carefully remove the victim from the circuit; and

4. Administer artificial respiration to the victim.

Electric current follows the path of least resistance through the body. In other words, it will flow into the body wherever the circuit is contacted and flow out wherever the body is best grounded. For this reason, persons working with or around electrical circuits or equipment should avoid contacting both the sources for the electricity and any grounded object.

Personnel working around electrical equipment should be acquainted with methods of artificial respiration and external cardiac compression. The standard technique for using the Rescue Breathing Method is described in Appendix D and that for Cardiopulmonary Resuscitation (CPR) is given in Appendix H.

403 RUBBER PROTECTIVE EQUIPMENT

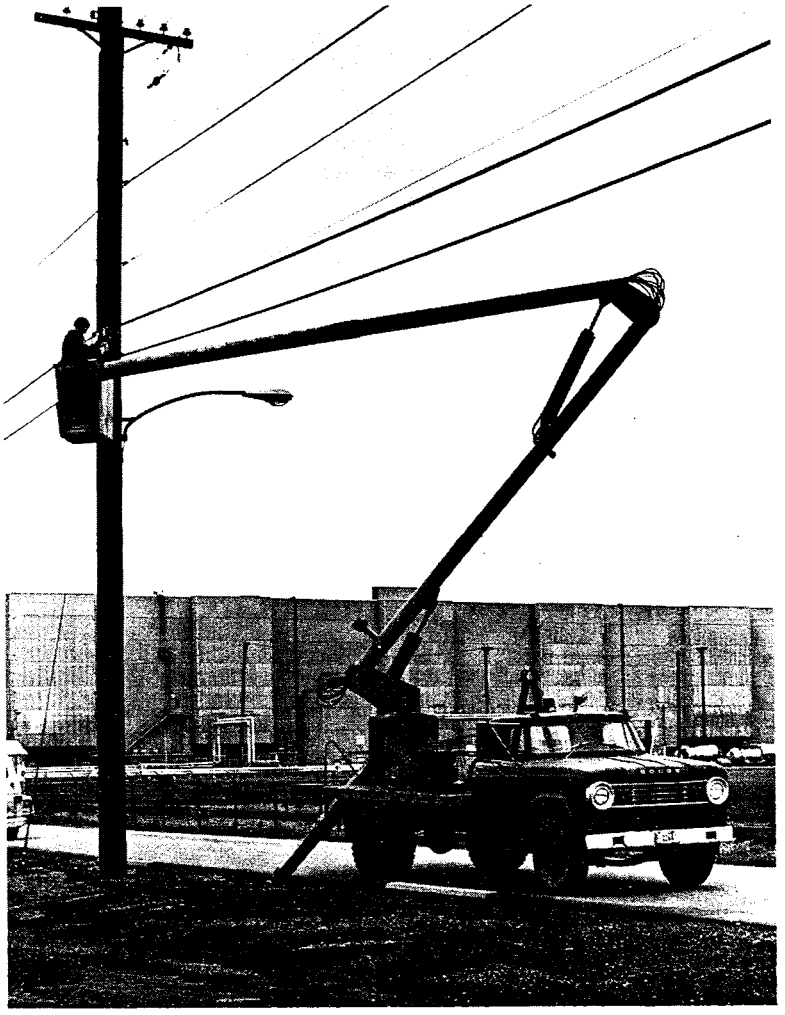
In many electrical maintenance and switching operations, rubber protective equipment, such as gloves, blankets, sleeves, etc., must be relied upon to ensure the safety of personnel. In view of the importance of these items of protective equipment, it is essential that they be maintained in excellent condition at all times.

Rubber protective equipment is to be used only for the purpose intended and is identified by a permanently applied serial number provided at the time of the initial inspection and test. The date of each inspection and test is placed on the item, and each used item must be returned for inspection and test in accordance with the following schedule.

Rubber Insulated Gloves (in use)	30 days
Rubber Insulated Gloves (Stores stock)	60 days
Rubber Insulated Line Hose	60 days
Rubber Insulated Hoods	60 days
Rubber Insulated Sleeves	60 days
Rubber Insulated Blankets	60 days
Hot Line Tools	60 days

In addition, any of these items which are of doubtful serviceability because of physical damage or for other reasons must be returned to Stores by the user for inspection and test before further use, regardless of whether or not they are scheduled for retest.

Used items of electrician's rubber protective equipment will be received by Stores and replacements issued item for item. The used equipment is transferred to the Laundry for cleaning. After cleaning, the rubber protective equipment is transferred to the Electrical Maintenance Test Section for inspection and testing prior to reissuance.



404 ELECTRICAL EXTENSION CORDS

Since outlets or light sources are not always located at the exact position for the job, electric extension cords are often used. Use of this type of equipment may involve serious hazards. Extension cords should not be placed in aisles, walkways, and around work places, presenting tripping and falling hazards. The use of defective extension cords has caused serious, even fatal, electric shocks and painful burns.

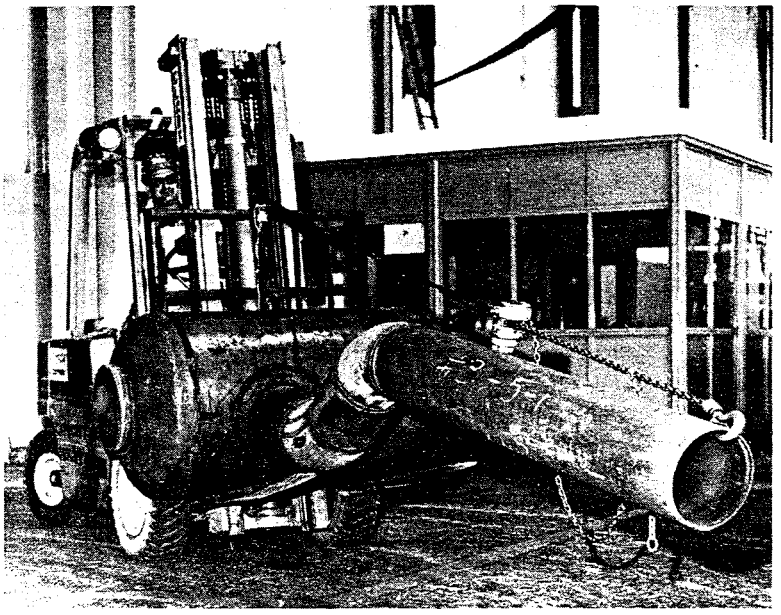
Extension cords are not intended as substitutes for permanent wiring. When it is necessary to use extension cords, the following precautions must be taken.

1. Extension cords must be equipped with the proper three-pronged male plug. All official electrical outlets on plantsite are the three-pronged female outlet type. Electrical cords for tools, etc., will be changed by the Electrical Maintenance Department. Never use a two-pronged electrical male plug in a three-pronged female crow's foot outlet.

2. When extension cords must cross areas frequently used by personnel or plant traffic, they must be covered by boards which will form a bridge, constructed so as not to cut or lie on the wires. Where possible, the extension cords must be strung overhead, but they must be high enough to clear ladders, materials, etc., carried beneath them or mobile equipment operating them.

3. An extension cord must not be hung with metal wires or on nails, and it must not be pulled or dragged over nails, hooks, tools, or other sharp objects which may cause cuts in the insulation. Pinch points, such as closing doors or lids on equipment, must be avoided.

4. Extension cords must be inspected by the users for small breaks, abrasions, or defects in the jackets. Attachments must be inspected for looseness, arcing conditions, or other mechanical defects.



SECTION 5 MECHANICAL SAFETY

501 ELEVATORS

Automatic hydraulic freight elevators are installed throughout the plant. As a safety measure, these elevators are designed so that they cannot be operated unless the shaft doors and car gates are closed. Do not block these switches to allow the elevator to run with the gates open.

The safe load limit is posted inside each elevator. Do not exceed the limit.

In case of emergency, follow the instructions contained in a laminated plastic container attached to the wall of the elevator cage.

502 BRIDGE AND BOOM CRANES

Only authorized personnel are allowed to operate

bridge and boom cranes. The equipment should be checked prior to use to ensure that it is in satisfactory working order. Personnel who operate this equipment should promptly report any failure or unsatisfactory operating condition to their immediate supervision.

Rules for Operating Cranes

1. The warning signal must be sounded each time the crane is put into operation or when it approaches employees.

2. Only authorized hand and arm signals must be used by a signal man on duty; verbal communications should not be used. Illustrations of authorized signals are given on the following pages.

3. Unless necessary, no one except the operator is to be on a crane while it is in operation.

4. A crane must not be left with a load suspended, and the load cables must not be used as "chokers" around the load.

5. A vehicle must not be loaded by means of a crane until the vehicle operator is out of the vehicle and clear of the load.

6. Cranes are not to be serviced while they are in operation.

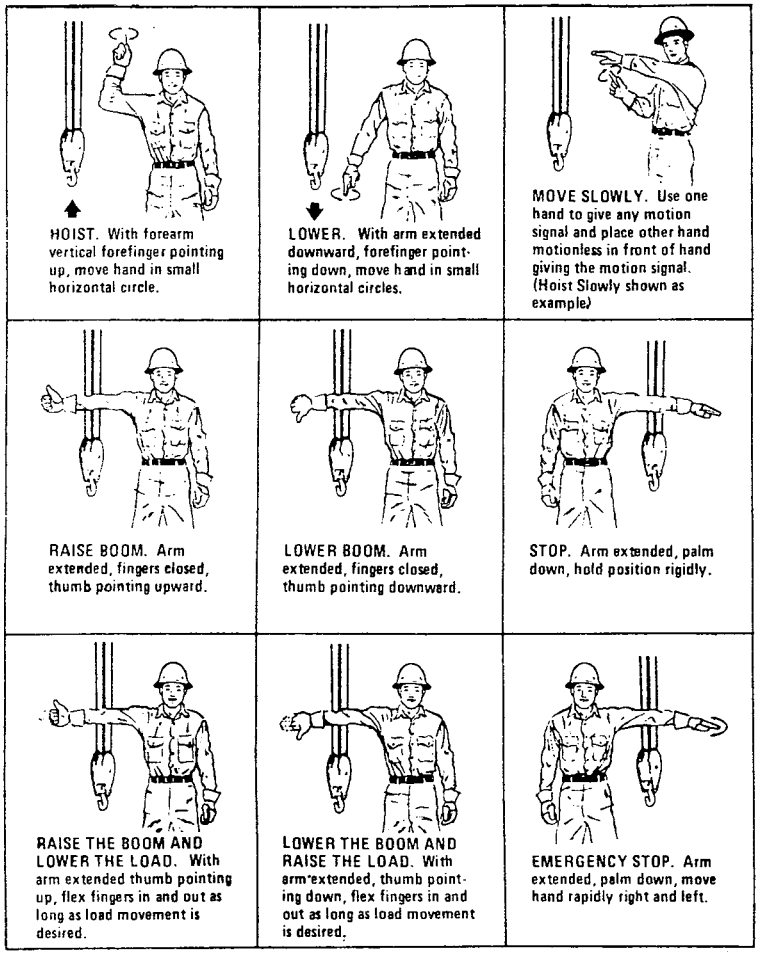
7. A substantial and durable rating chart with clearly legible letters and figures shall be provided with each crane. The chart should be securely fixed to the crane cab in a location easily visible to the operator while he/she is seated at the control station.

503 RULES FOR PENDULUM-OPERATED CRANES

1. The operator of a pendulum crane must be sure that he/she is clear of the load at all times.

2. The operator must sound a warning signal each time the crane is put into operation, as well as when it approaches employees.

STANDARD BOOM CRANE SIGNALS



HOIST. With forearm vertical forefinger pointing up, move hand in small horizontal circle.

LOWER. With arm extended downward, forefinger pointing down, move hand in small horizontal circles.

MOVE SLOWLY. Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist Slowly shown as example)

RAISE BOOM. Arm extended, fingers closed, thumb pointing upward.

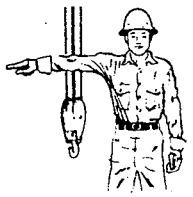
LOWER BOOM. Arm extended, fingers closed, thumb pointing downward.

STOP. Arm extended, palm down, hold position rigidly.

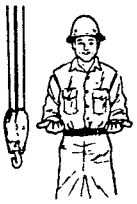
RAISE THE BOOM AND LOWER THE LOAD. With arm extended thumb pointing up, flex fingers in and out as long as load movement is desired.

LOWER THE BOOM AND RAISE THE LOAD. With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.

EMERGENCY STOP. Arm extended, palm down, move hand rapidly right and left.

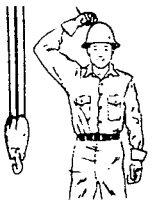


SWING. Arm extended point with finger in direction of swing of boom.

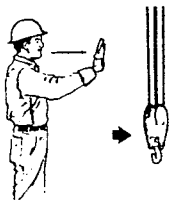


EXTEND BOOM. (Telescoping Booms) Both fists in front of body with thumbs pointing outward.

RETRACT BOOM. (Telescoping Booms) Both fists in front of body with thumbs pointing toward each other.



USE MAIN HOIST. Tap fist on head; then use regular signals.



TRAVEL. Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.

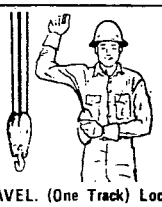
USE WHIP LINE. (Auxiliary Hoist) Tap elbow with one hand; then use regular signals.

INSTRUCTIONS TO SIGNAL MEN

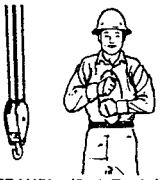
1. Only one person to be signalman
2. Make sure the Operator can see you and acknowledges the signal given
3. Signalman must watch the load—the Operator is watching you
4. Don't swing the load over other workmen; warn them to keep out of the way

WATCH FOR OVERHEAD LINES OR OTHER OBSTRUCTIONS.

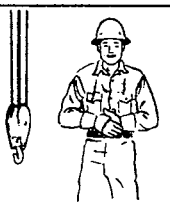
CRAWLER OR TRACK SIGNALS



TRAVEL. (One Track) Lock the track on side indicated by raised fist. Travel opposite track in direction indicated by circular motion of other fist, rotated vertically in front of body. (For crawler cranes only.)

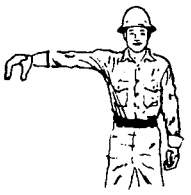


TRAVEL. (Both Tracks) Use both fists, in front of body, making a circular motion, about each other, indicating direction of travel, forward or backward. (For crawler cranes only.)



DOG EVERYTHING. Clamp hands in front of body.

CLAM BUCKET SIGNALS



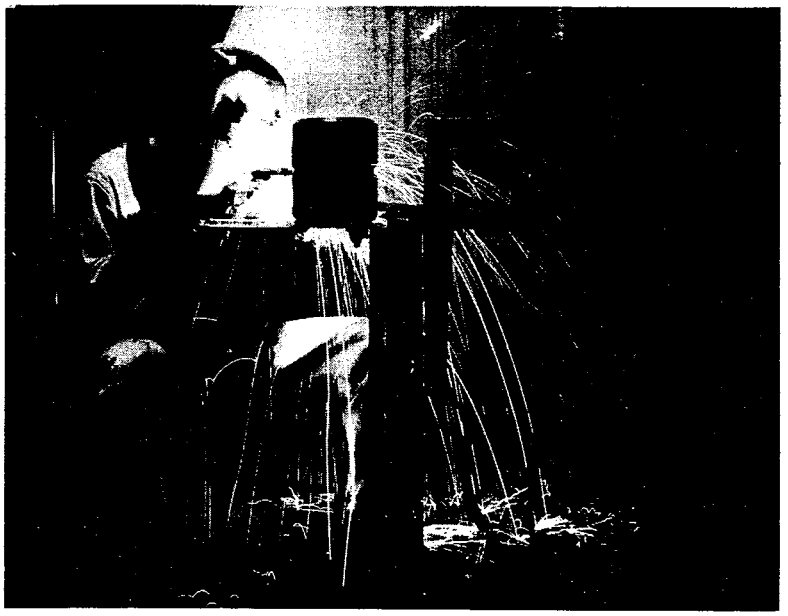
OPEN

CLOSE

The temperature, pressure, and other limitations for pressure vessels normally are stamped on a nameplate attached to all such vessels. These limitations provide an adequate margin of safety.

Periodic inspections of pressure vessels are made by qualified personnel of the Safety Department, and permanent records of inspection and service data are kept. However, operators of systems containing pressure vessels shall check and report any evidence of leakage, safety device malfunctioning, and corrosive damage.

Pressure relief devices have been set by authorized personnel; no other employees should tamper with them.



SECTION 6 WELDING

601 FIRE SAFETY DURING WELDING AND CUTTING

A major cause of fires in industrial plants is the lack of adequate safety precautions during welding or cutting operations. Most such fires occur from the use of portable equipment in areas where welders are not aware of existing conditions. Therefore, thorough inspection of the premises, followed by the appropriate precautionary measures, should precede welding and cutting operations whenever such work is conducted outside an established welding shop.

Rules For Performing Field Welding Operations

1. Determine that sprinklers, if available, are in working order.

2. Check cutting and welding equipment to ensure that they are in good condition.

3. Observe the following rules within a 35-ft. radius of the work area:

   a. Clear floors of combustible material or flammable liquids.

   b. Wet down combustible floor and cover it with damp sand, metal, or other shields.

   c. Cover non-movable combustible material or flammable liquids with noncombustible covers, guard, or metal shields.

   d. Cover all wall and floor openings.

4. Observe the following rules for working on walls or ceilings:

   a. Use noncombustible covers beneath the work area to collect sparks.

   b. Clear all combustible materials from the opposite side of the wall.

5. Observe the following rules for working on enclosed equipment, such as tanks, containers, dust, dust collectors, etc.:

   a. Clean equipment of all combustibles.

   b. Purge containers of flammable vapors and check them with an explosimeter to determine if the containers are safe.

   c. Determine if a fire watch is required, and if not, check the work area 30 minutes after completion of work to verify that the area is clear for operation.

Upon request from supervision, the Fire Department will make a fire inspection of the area and recommend such special precautions as may be required.

General Rules for Welding or Cutting

1. Do not use a torch or an arc on either a completely closed vessel or a coded vessel.

2. Do not perform welding or cutting in or near rooms or areas containing flammable vapors or liquids without first taking special precautions.

3. Guard exposed combustible materials that must remain in an area near welding or cutting operations with approved fire-resistive material.

4. Observe special precautions when welding or cutting on containers that have been used for storage of flammable liquids and oils. (Contact the Fire Department prior to cutting or welding on such containers.)

602 GAS WELDING

Rules for Performing Gas Welding Operations

1. Do not use oil, grease, and pipefitting compounds in making connections in gas welding equipment. Do not handle oxygen cylinders or apparatus with oily hands or gloves.

2. Do not place welding cylinders where they could be struck or knocked over by trucks, railroad cars, cranes, etc.; where other material could fall on them; or where they can become part of an electric circuit.

3. Keep acetylene cylinders on gas welding equipment in an upright position and keep both acetylene and oxygen cylinders securely fastened.

4. Equip acetylene cylinders with either a valve wheel or a wrench on the shut-off valve continuously during use.

5. Valve off acetylene and oxygen cylinders not in use so that no pressure is on the gauges.

6. Make tests for leaks only with a soap solution.

7. Do not use oxygen to dust clothing, provide ventilation, or blow chips or dirt from a work place.

8. Do not use a leaky hose, and do not repair a hose with tape.

9. Light torches only with prescribed lights.

10. Do not use oxygen cylinders containing less than 50 psig oxygen.

11. Make every effort to keep hoses from crossing walkways, aisleways, or areas subject to foot or vehicle traffic.

12. Close cylinder valves when a task involving their use is finished.

13. Always keep valve protection caps in place, and hand tight, except when cylinders are in use or connected for use.

603 ELECTRIC AND ARC-AIR WELDING

Rules for Performing Electric and Arc-Welding Operations

1. Check all electrical connections for tightness before starting operations.

2. Remove electrodes not in use from their holders.

3. Ensure that cables are free of splices for a minimum of 10 feet from the electrode holder.

4. Cover all exposed lugs at welding machines with some type of insulation cover.

5. Keep welding cables dry and free from grease and oil.

6. Wear prescribed eye protection at all times during welding.

7. Make every effort to keep aisleways and work areas free of lines.

8. Place electrode holders not in use so that they cannot make electrical contact with persons, conducting objects, fuel or compressed gas tanks.

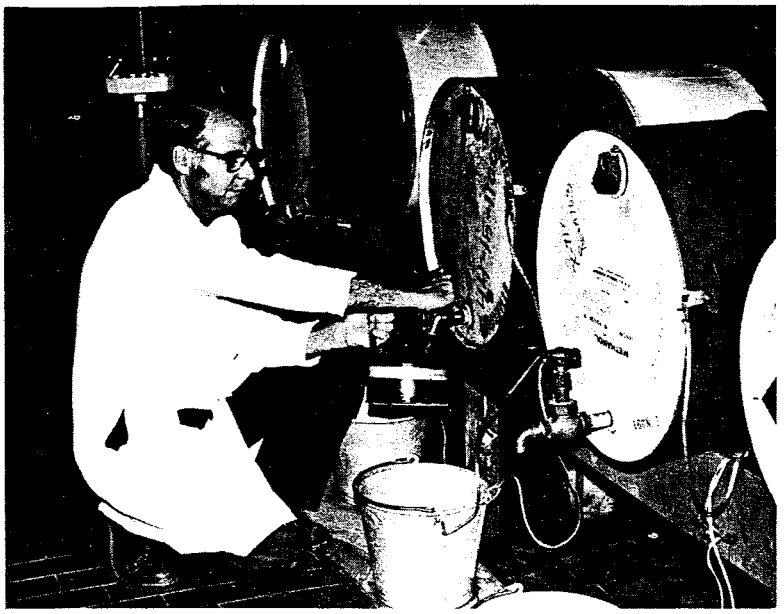
9. Spread out coiled welding cable before welding operations begin so that serious overheating and damage to insulation will be avoided.

10. Promptly report any malfunction, equipment defects, or unsatisfactory operation to the immediate supervision.

11. Wear prescribed personal protective clothing at all times during welding.

604 WELDING PERMITS

The foreman-in-charge will ensure that all safety precautions are taken prior to the start of welding and will issue a properly completed "Hazardous Work Permit," Form A-148, when required. Information on filling out the Welding and Cutting Section of the HWP is detailed in Standard Practice Procedure M-7. HWPs are not required for shop welding.



SECTION 7 FIRE CONTROL

701 SPONTANEOUS HEATING AND IGNITION

Some materials catch fire without an external source of ignition. This phenomenon, called spontaneous ignition, provides a very important reason for good housekeeping practices throughout the plant.

Examples of some materials susceptible to spontaneous ignition are:

1. Fibrous or finely divided materials treated with or containing oil;

2. Finely divided materials, such as iron, cobalt, nickel, uranium, uranium hydride, zirconium, and coal dust; and

3. Solvents and acids, such as nitric acid, used in conjunction with paper and rags.

702 FLAMMABLE LIQUIDS

A flammable liquid is one which gives off vapors that will burn (i.e., a liquid having a flash point at or above 100°F). The more common flammable liquids are gasoline, kerosene, acetone, ether, and alcohols. Some manufactured liquids, such as paint, cleaning solutions, rubber cement, thinners, etc., are also considered flammable liquids.

The flash point of a liquid is the lowest temperature at which it gives off enough vapor to form a burnable mixture with air. The flash point is generally used as an index of the relative hazard of a liquid.

A flammable liquid, such as kerosene, with a flash point above the normal summer temperature will not normally give off enough vapors to form a burnable vapor-air mixture. However, these liquids are easily ignited, and once ignited, their burning will produce the heat necessary to vaporize the liquid.

Exposure to air should be avoided in the handling of flammable liquids. They must be handled and stored in closed metal containers, which are clearly labeled as to the contents, and marked with a 1-inch wide, painted yellow band. These practices will prevent accidental spillage and will contain the vapors. Five gallons or less should be stored in approved safety cans.

The following chart lists some of the common flammable liquids with their flash points.

COMMON FLAMMABLE LIQUIDS AND THEIR FLASH POINTS

Class IA	Class IB	Class IC
Flash point at or below 73°F and a boiling point below 100°F	Flash point below 73°F and a boiling point at or above 100°F	Flash point at or above 73°F and below 100°F
Gasoline	Acetone	Butyl Ether
Ethyl Ether	Benzene	Butyl Alcohol
	Naphtha	
	Ethyl Alcohol	
	Carbon Disulfide	
	Ethyl Acetate	

Class II	Class III
Flashpoint at or above 100°F below 140°F	Flashpoint at or above 140°F
Mineral Spirits	Aniline
Kerosene	Creosol
Turpentine	
Fuel Oil	

General Rules for Handling Flammable Liquids

1. Treat mixtures of flammable liquids as if they consist entirely of the most flammable component, regardless of the ratio of the mixture.

2. Use portable containers that are the approved standard safety type, and properly identify all containers.

3. Clean up spilled flammable liquid immediately.

4. Provide proper ventilation at the place of usage and storage.

5. Keep flammable liquid storage to an absolute minimum.

Special precautions must be taken in areas where flammable liquids are stored, handled, or used in quantities, or where loading or unloading operations are performed. "No Smoking" signs must be obeyed.

Spark discharges from static electricity buildup create fire and explosion hazards when flammable liquids are poured from one container to another. During filling operations, a wire bond must be provided between the storage container and the container being filled. In addition, it is advisable to have the bonding wire or receiving container grounded. When flammable liquids are poured from one container to another, the lip of one container should rest on the edge or lip of the other container, which is set on a grounded surface, throughout the pouring.

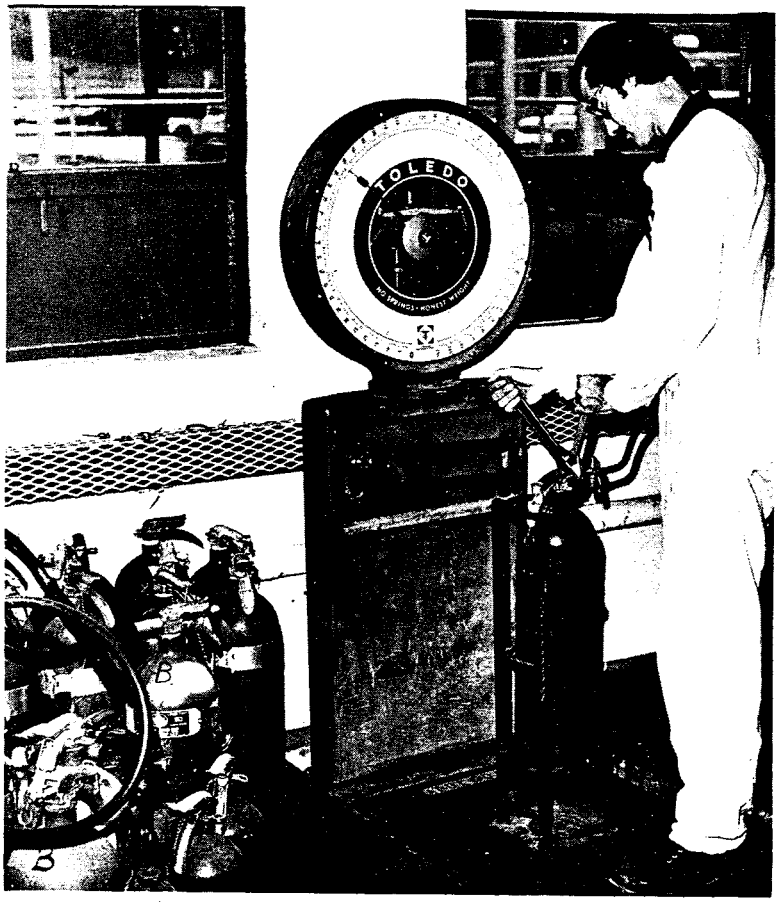
Most flammable liquids are toxic, and adequate ventilation must be provided where such liquids are used, handled, or stored.

703 PORTABLE FIRE EXTINGUISHERS

Most serious industrial fires are caused by permitting small fires to spread. Because of the time delay between the detection of a fire and the arrival of the Fire Department, portable extinguishers have

been located throughout the plant. A general rule to follow upon discovering a small fire is to call the Fire Department at once and then use the proper available portable fire extinguishers.

Whenever a portable fire extinguisher is used for any purpose, the Fire Department must be notified immediately even though the extinguisher is not fully emptied. The used extinguisher should be placed on the floor near its original location; it must <u>never</u> be placed back on the mounting bracket. All used extinguishers are serviced and replaced by the Fire Department immediately after notification.



Fires are classified by the National Fire Protection Association according to the type of material involved. The recommended fire extinguisher to be used on each class is given below.

TYPE OF FIRES AND RECOMMENDED EXTINGUISHERS

Classification	Type of Material Involved	Recommended Extinguishers (In Order)
Class A	Wood, Paper, Rags, Trash, etc.	Water or ABC-type Dry Chemical
Class B	Lube Oil, Gasoline, and other Flammable Liquids	Dry Chemical, Carbon Dioxide
Class C	Electrical Equipment	Carbon Dioxide, Dry Chemical
Class D	Metal	Special Chemical

General Rules for Fighting Fires

1. Be sure that a safe exit is always available.

2. Stand so that drafts and wind carry smoke and flames away from you.

3. Stay outside when the fire is confined to a small room or an enclosed area.

4. Direct the extinguishing agent at the base of the burning materials.

5. Start putting out the fire at the closest edge and sweep it completely from one side to the other rather than in a narrow path.

6. Start extinguishing a wall fire at the base and progess upward.

7. Turn off the electric current, if possible, in cases involving electrical equipment to prevent reignition or electric shock.

8. Ventilate the area to remove any poisonous gases formed.

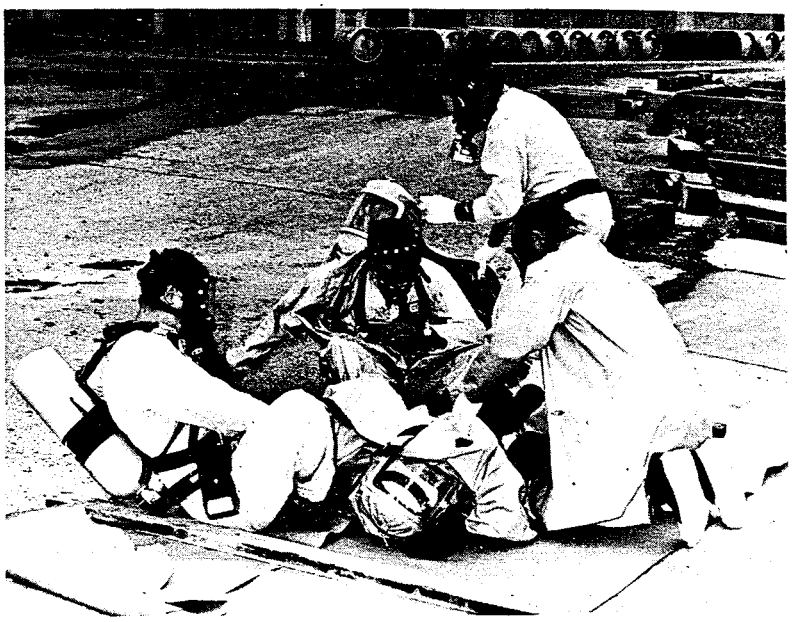
704 AUTOMATIC FIRE PREVENTION SYSTEMS

Permanent fire protection systems which automatically detect or control fires are installed throughout most areas of the plant. These systems provide fire protection for buildings, equipment, and personnel. Very sensitive smoke and fire detectors are installed in plant computer rooms, switchgear rooms, and certain laboratories where early warning of fire is essential. Smoke detection systems are also installed in most areas of the process building. They will detect abnormal smoke conditions in the air exhaust ducts, give a signal to the ACR indicating that the system has operated, and adjust the building's ventilation system to prevent recirculation of the affected air.

Automatic sprinkler systems have been installed in most buildings on plantsite. These systems consist of heat sensitive piping and sprinkler heads that at a definite temperature will discharge water.

Operation of any of these systems is announced in the Fire Department's headquarters.

Several buildings without automatic sprinkler systems have been provided with heat detection systems which will detect abnormal heat conditions and will summon the Fire Department through the fire alarm system.



SECTION 8 RADIOLOGICAL SAFETY

This section still is being revised; it will be available after June 1, 1979.